Space Weather Technical Forecast

Issued on Wednesday, 28 August 2024 at 00:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: M-class flares and R1/R2 blackouts likely. Slight chance of coronal hole fast wind arriving on 28-29 Aug.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Activity has been Moderate in the last 24 hours, with a single M-class flare peaking at M1.1 at 27/0943 UTC, originating from AR3796.

There are ten sunspot regions on the visible disc, one of which is currently unnumbered in the northeast quadrant. AR3800, in the southwest quadrant, remains the most likely and notable flare source. It features a large leading spot followed by a series of smaller spots, which has now lost its weak delta spot on one of its intermediate spots. AR3799, near south centre disc, remains largely unchanged, with a big leading spot followed by a large amount of small but gradually fading spots. AR3790 is now rotating off the disc, therefore is not included in this analysis. AR3796 has recently shown slight decay of penumbra on one of its trailing spots. AR3801 continues to display a large amount of small spots on its trailing portion but these are gradually fading. AR3803 near east limb has shown some minor growth in recent hours, but given its relative complexity, remains largely inactive. The remaining regions are either small or magnetically simple and mostly stable.

No Earth-directed CMEs were observed in coronagraph imagery in the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind parameters, as measured by ACE, indicate that a CME arrived at L1 at around 27/0735 UTC, which left the Sun on 23 Aug. The solar wind speed increased from 250 to 330 km/s. Density was below well average but instantly rose to above average levels. The Interplanetary Magnetic Field (IMF), Bt, became moderate, increasing from 3nT and peaking at 13nT. The north-south component, Bz, was largely negligible through the period but started to show a more erratic behaviour after 27/0735 UTC, varying between +7nT and -9nT. Phi angle was positive (away from the sun) initially but changed orientation at 26/1600 UTC and became negative (towards the Sun). Resulting geomagnetic activity was mostly Quiet (Kp 0-2) with an Unsettled (Kp 3) interval observed 27/0600-0900 UTC.

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background. High energy electron flux (greater than 2MeV) observed at GOES16 was mainly at background, but did have a brief diurnal rise to moderate levels. The 24-hour fluence was below the Active threshold, with 3.91e6 integrated pfu observed at 28/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: M-class flares are expected with a slight chance of isolated X-flares.

Solar Wind /Geomagnetic Activity: The CME that left the Sun on 23 August arrived at L1 early on the 27 Aug, but impacts on the geomagnetic activity were limited, with only a few Unsettled

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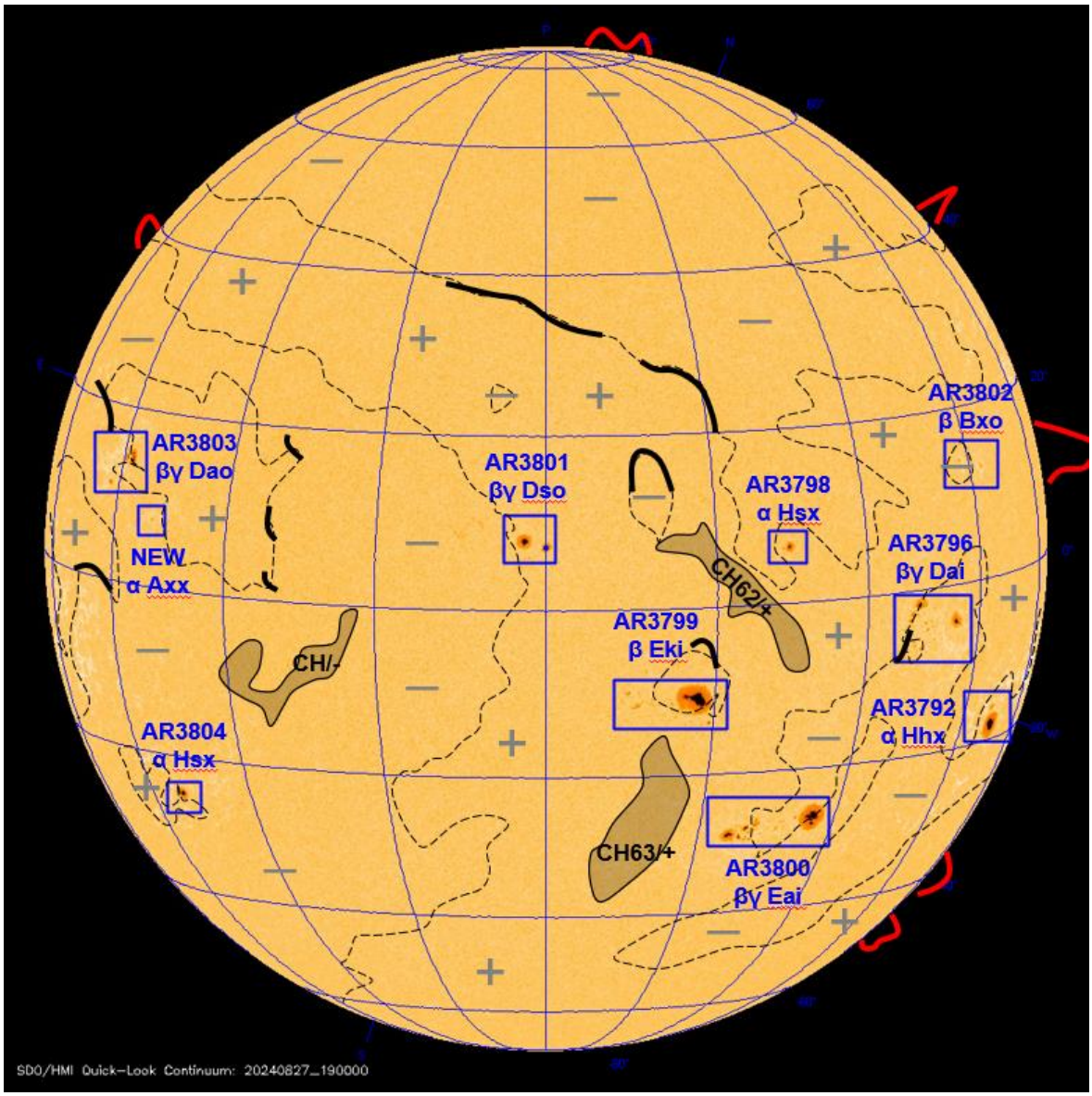
intervals. However, a fast wind associated with CH62 and perhaps CH63 may slightly enhance the solar wind speed late on Day 1 or early on Day 2 (28-29 Aug) but again, geomagnetic activity is expected to be mostly Quiet with the slight chance of Unsettled intervals. Largely Quiet activity on Days 3 and 4 (30-31 Aug).

Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background, but with the potential to rise in response to any notable flares, giving a slight chance of reaching the S1 Minor Radiation Storm level. High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to persist below the Active level.

Figure 1. Solar Analysis Valid 27/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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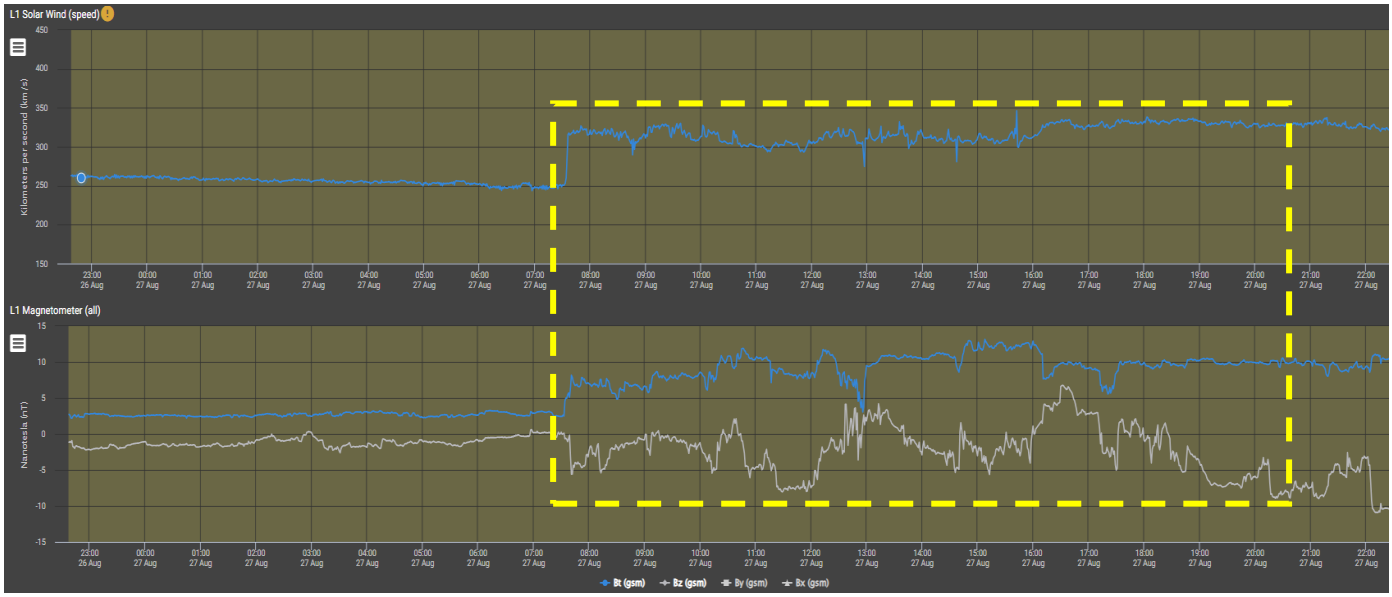
Geomagnetic Storms:

The CME that was seen leaving the sun on 23 August arrived at L1 early on the 27 Aug, only leading to a slight enhancement to the solar wind speed and density. Consequently, impacts on the geomagnetic activity were limited, with only a couple of Unsettled intervals observed. No other Earth-directed CMEs feature in the forecast.

Figure 2. Real time solar wind parameters for IMF and solar winds, which shows the arrival of the CME at L1 (dashed yellow rectangle).



Coronal hole 62/+ near centre disc may cause some slight enhancement to the solar wind later on Day 1 or early Day 2 (28-29 Aug). This coronal hole is persistent, but the forecast is somewhat uncertain due to contamination from previous CME impacts during the previous rotation. While the MOSWOC ENLIL model predicts a slight enhancement a day earlier than expected, its forecast of only a very minor increase in solar wind is considered accurate. Geomagnetic activity is expected to be mostly Quiet throughout the period, with a slight chance of Unsettled intervals late day1 or early day 2 (28-29 Aug) if the fast wind from CH62/+ arrives.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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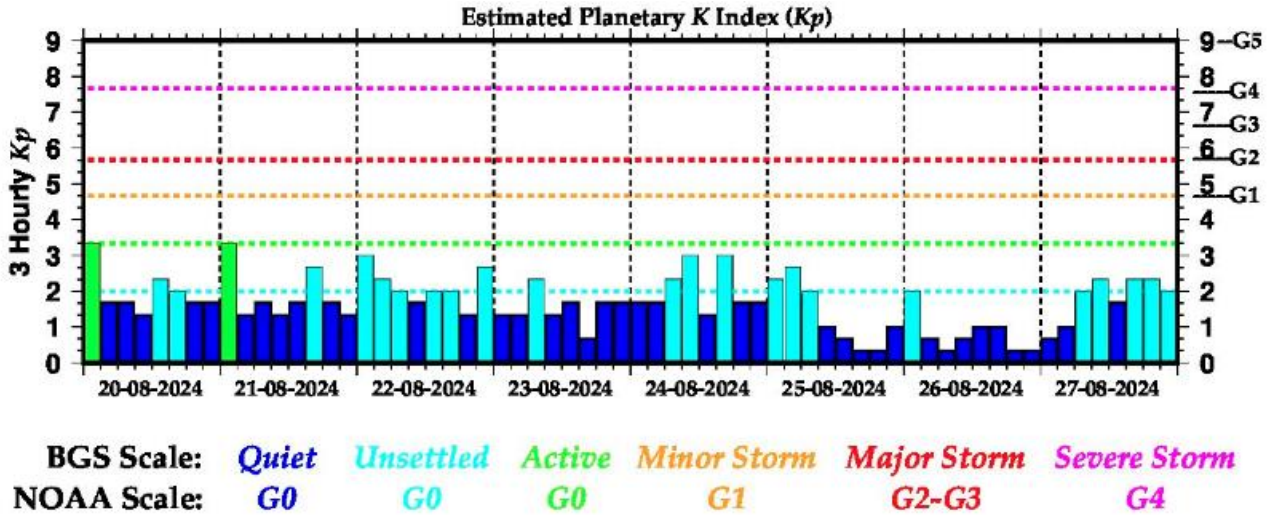
Figure 3. BGS/NOAA estimated planetary K index (Kp) shows limited impacts from the aforementioned CME arrival early on 27 Aug.



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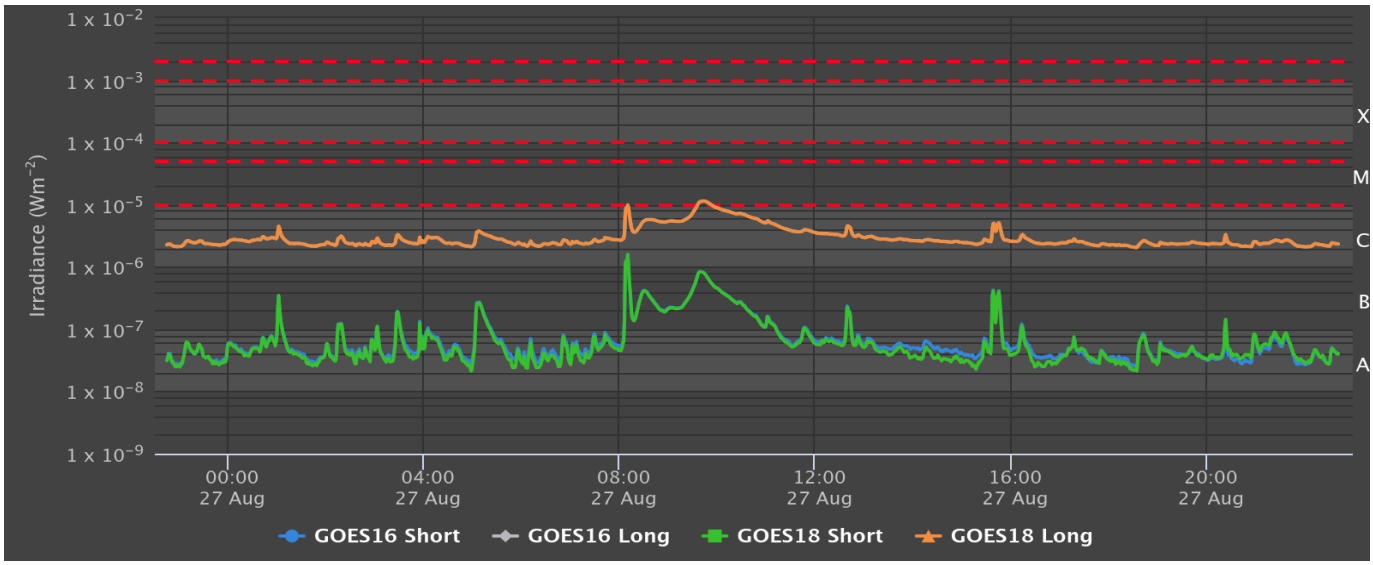
Radio Blackouts - X-Ray Flares:
Flare activity is expected to remain Moderate, with occasional M-class flares and a slight chance of isolated X-class flares given the large number of active region currently on the visible disk. AR3796 is considered to be the most likely source of any notable flares, while AR3799 and AR3800 remain largely inactive despite their apparent complexity and large size. Far-side sounding data also suggests the potential for a large oncoming region to appear in the next 12 hours or so. Therefore the flare risk has been maintained throughout, with oncoming regions balancing the gradual loss of flare risk from AR3790, which has now rotated off the west limb.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	65	65	65	65
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 4: GOES16/18 X-Ray flux



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux, as observed by GOES-18, is currently at background and expected to persist at this level. There are a number of moderately sized sunspot regions on the western hemisphere and moving into an increasingly favourable position to give proton enhancement, should any significant flare occurs disc. However, these regions currently lack complexity that is ordinarily associated with the more proton rich events. Consequently, the chance of seeing the proton flux rising or exceeding the S1 Minor Radiation Storm threshold is considered low through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	10	10	10	10
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

High energy electron flux as observed by GOES-16 is currently at background and forecast to remain at this level, although likely with some moderate diurnal fluctuations.

Fluence is expected to remain below the Active (1e8 integrated pfu) threshold through the period. MOSWOC REFM is currently providing reasonable guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

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